

Appl. No. 09/508,512
Amendment dated: July 26, 2004
Reply to OA of: May 4, 2004

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of Claims:

Claims 1-41(canceled).

42(new). Apparatus for monitoring the activity of tritiated water vapour and other hydrophilic tritiated species in a gas, which apparatus comprises:

(a) a hygroscopic scintillator element comprising a solid scintillator material having a layer of hygroscopic material thereon; and

(b) means for measuring light emitted from said hygroscopic scintillator element, the amount of light emitted from said scintillator element providing a measure of the tritium containing species in said gas;

wherein said hygroscopic scintillator element is provided in a substantially light tight container including inlet means adapted to allow the gas to contact the scintillator element without permitting entry or exit of light to or from said container.

43(new). Apparatus according to claim 42 which further comprises means for contacting said gas with said hygroscopic scintillator element.

44(new). Apparatus according to claim 42 which further comprises an outlet in said container to allow passage of said gas or vapour therethrough.

45(new). Apparatus according to claim 44, wherein said solid scintillator material is porous.

46(new). Apparatus according to claim 43, which comprises a pump to facilitate the passage of gas through said container.

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47(new). Apparatus according to claim 42 wherein the light emitted by said hygroscopic scintillator element is measured remotely by said light measuring means spatially separated from said hygroscopic scintillator, but optically connected thereto by means of a light guide.

48(new). Apparatus according to claim 42 wherein said scintillator element is provided in the form of a sheet, fibre, rod, spiral roll, powder, a powder compact, varnish, paint, or a combination of said forms.

49(new). Apparatus according to claim 42 wherein said measuring means comprises one or more photomultiplier tubes, multichannel plates or photodiodes.

50(new). Apparatus according to claim 49 wherein the rate of signal pulses from said measuring means is measured and used to indicate the tritium radiotoxicity of said gas, and/or its tritiated water activity, on a meter, a digital display, as an audible signal and/or as an electrical output to a computer, data logger, recorder or control electronics.

51(new). Apparatus according to claim 49 wherein a plurality of a photomultiplier tube, multichannel plate or photodiode is provided.

52(new). Apparatus according to claim 50 wherein the time averaged output of said measuring means is measured as a continuous current, and used to indicate the tritium radiotoxicity of said gas on a meter, a digital display as an audio signal, and/or as an output to a computer, data logger, recorder, control System.

53(new). Apparatus according to claim 42 which further comprises a non-discriminating tritium monitor so as to measure, by difference, the concentrations in said gas or vapour of both tritiated water or other possible hydrophilic species and elemental tritium or other hydrophobic radioactive species present.

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54(new). Apparatus, according to claim 53, wherein said non-discriminating monitor is substantially identical to said hygroscopic scintillator element, with the exception that the hygroscopic layer is omitted in the non-discriminating monitor.

55(new). Apparatus according to claim 42 which further comprises a second sealed radiation monitor to compensate for background radiation fields, by subtraction.

56(new). Apparatus according to claim 54 wherein said sealed radiation monitor is substantially identical to said hygroscopic scintillator element and sealed in a container free of radioactive gas.

57(new). Apparatus according to claim 42 wherein the gas to be monitored comprises air.

58(new). Apparatus according to claim 42 which is incorporated in a breathing mask.

59(new). Apparatus according to claim 42, wherein said solid scintillator material is doped zinc sulphide.

60(new). Apparatus according to claim 42, wherein said solid scintillator material comprises any of, a plastic, an inorganic phosphor, an oxide based material, a glass or a combination of these materials.

61(new). Apparatus according to claim 42, wherein said hygroscopic material comprises a layer of a hygroscopic or deliquescent substance as a solution or as an aqueous gel.

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62(new). Apparatus according to claim 42, wherein said hygroscopic layer is from 0.4 to 1 micron in thickness.

63(new). Apparatus according to claim 42 wherein said hygroscopic material comprises an aqueous or gel solution of a deliquescent salt, base or organic salt or an inorganic or organic substance which can adsorb water, or a combination of any of said substances.

64(new). Apparatus according to claim 42 wherein said hygroscopic material is selected from the group consisting of zinc chloride, potassium acetate, phosphoric acid and lithium chloride.

65(new). Apparatus according to claim 42 which further comprises a hydrated solid such as zeolite.

66(new). A method for monitoring the activity of tritiated water vapour or other hydrophilic tritiated species in a gas, which method comprises:

(a) providing an apparatus according to claim 42 and contacting hygroscopic scintillator element thereof with a gas to be tested; and

(b) measuring the light emitted from said hygroscopic scintillator element, the amount of said light emitted from said scintillator element providing a measure of the activity of the tritiated water vapour or said hydrophilic tritiated species in the gas.

67(new). A method according to claim 66, wherein the container additionally includes an outlet to allow passage of said gas therethrough.

68(new). A method according to claim 67, wherein said solid scintillator material is porous.

69(new). A method according to claim 66, wherein the light emitted by said hygroscopic scintillator is measured remotely by measuring means spatially separated from said hygroscopic scintillator, but optically connected thereto.

70(new). A method according to claim 66, wherein the time averaged output of the measuring means is measured as a continuous current, and used to indicate the tritium radiotoxicity of said gas, and/or its tritiated water activity on a meter, a digital display as an audible signal, and/or as an output to a computer, data logger, recorder, control system.

71(new). A method according to claim 69, wherein said measuring means comprises one or more photomultiplier tubes, multichannel plates or photodiodes.

72(new). A method according to claim 71, wherein the rate of signal pulses from said measuring means is measured and used to indicate the tritium radiotoxicity of said gas, and/or its tritiated water activity, on a meter, a digital display as an audible signal, and/or as an output to a computer, data logger, recorder, or control system.

73(new). A method according to claim 71, wherein more than one photomultiplier tube, multichannel plate or photodiode is provided.

74(new). A method according to claim 66, which further comprises using a non-discriminating tritium monitor in order to measure, by difference, the activities in said gas of both tritiated water and elemental tritium.

75(new). A method according to claim 74, wherein the non-discriminating monitor is substantially identical to the scintillator element of said apparatus, with the exception that the hygroscopic layer is omitted in the non-discriminating monitor.

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76(new). A method according to claim 66, wherein said gas to be measured is air.

77(new)A method according to claim 70, wherein said measuring means comprises one or more photomultiplier tubes, multichannel plates or photodiodes.